

REMARKS

Applicants are amending their claims in order to further clarify the definition of various aspects of the present invention. Specifically, Applicants have amended claim 1 to recite that at least one of "R₄ and R₅" is selected from the group consisting of formulas (7)-(9); and Applicants have further amended claim 1 to incorporate therein the subject matter of each of claims 7 and 9. In light of amendments to claim 1, claims 7, 9 and 12 have been cancelled without prejudice or disclaimer, and each of claims 5 and 6 have been amended to delete further definition of the component (A) therefrom.

In connection with amendments to claim 1, note previously considered claims 7 and 9, and also note pages 19 and 20 of Applicants' Substitute Specification, submitted with the Preliminary Amendment filed September 27, 2006.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the references applied by the Examiner in rejecting claims in the Office Action mailed September 14, 2010, that is, the teachings of the U.S. patent documents to Ushirogouchi, et al., Patent No. 6,071,670, and to Suzuki, et al., Patent Application Publication No. 2002/0090569, under the provisions of 35 USC 103.

Initially, note that the Examiner did not reject previously considered claim 9 over the teachings of Suzuki, et al.; and note also that the subject matter of claim 9 has been incorporated into present claim 1, the sole independent claim in the application. In view thereof, it is respectfully submitted that the prior art rejection over the teachings of Suzuki, et al. is moot, and no further specific discussion thereof is necessary.

In any event, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such a photosensitive resin composition as in the present claims, including the specified heat-resistant polymer having an acid functional group and/or a substituent derived therefrom, and further defined by general formula (1) or (2) as in claim 1, and wherein the composition further includes, in addition to a photoreactive compound and a solvent, a compound represented by the general formula (10) in claim 1, with each of R_4 and R_5 of this general formula (10) representing hydrogen or a monovalent organic group, at least one of R_4 and R_5 being selected from the group consisting of formulas (7)-(9) in claim 1. See claim 1.

Moreover, it is respectfully submitted that the teachings of the applied references would have neither taught nor would have suggested such photosensitive resin composition as in the present claims, having features as in claim 1, as discussed previously, and, additionally, wherein R_3 of the formulas (7)-(9) is selected from the group consisting of those set forth in claim 18.

In addition, it is respectfully submitted that the references as applied by the Examiner would have neither taught nor would have suggested such photosensitive resin composition as in the present claims, having features as discussed previously in connection with claim 1, and, additionally, wherein R_3 in the general formulas (7)-(9) is a monovalent organic group having 1-20 carbon atoms (see claim 13); and/or wherein the compound of the component (B) serves as a chain extender capable of increasing molecular weight of the polymer of the component (A) during a heat treatment of the photosensitive resin composition (note claim 14); and/or amounts of the compound of the component (B), relative to amount of polymer of the component

(A), in the photosensitive resin composition, as in claims 15 and 16; and/or substituents in component (B) as in claims 5 and 6.

Furthermore, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such photosensitive resin composition as in the present claims, having features as discussed previously in connection with claim 1, and, moreover, wherein the acid functional group in the polymer of the component (A) is a carboxyl group and/or a phenolic hydroxyl group (see claim 8).

The present invention relates to a photosensitive resin composition, method of use thereof and products formed therewith, such photosensitive resin composition being useful, for example (and not to be limiting), as a heat-resistant photosensitive material in a surface protecting film or interlayer dielectric film for a semiconductor device.

In the semiconductor industry, in recent years, organic materials having heat resistance, such as polyimide resins, have been used in, e.g., interlayer dielectric films. As described in the last full paragraph on page 2 of Applicants' Substitute Specification, improvement of development properties of photosensitive resins is important, and therefore the resin is comprised of a polymer having a low molecular weight for increasing solubility. However, polymers having a low molecular weight exhibit unsatisfactory mechanical properties after curing, and thus conventional photosensitive resin materials have a problem in that they cannot exhibit advantageous resin properties.

Against this background, and as a result of intensive studies by the present inventors, it has been found that by using a specified heat-resistant polymer or a precursor thereof having an acid functional group or a substituent derived therefrom,

together with a compound having specific functional groups, the resin component can be cured to have an increase in molecular weight, so that a cured resin having desired properties can be formed, without sacrificing development properties. Note the first full paragraph on page 3 of Applicants' Substitute Specification.

Specifically, through use of the compound of the component (B) as in the present claims, together with the recited polymer of the component (A), a photosensitive resin composition is achieved which has good development properties, yet which exhibits good properties as a layer after curing.

That is, according to the present invention, the polymer (A) has an acid functional group or its derivative, and compound (B) has an amine functional group; and the reaction therebetween achieves chain extending, during post exposure baking, resulting in a molecular weight increase of the polymer, as a result of which the composition before baking has properties such as photosensitivity and resolution, whereas the cured composition (that is, after baking) has excellent properties for a cured layer such as elongation properties.

Thus, as described on page 7, lines 28-31, of Applicants' Substitute Specification, component (B) is reacted with the acid functional group and/or substituent derived therefrom in component (A) due to heating, to cause polymer (A) to have a higher molecular weight, and achieve advantages according to the present invention.

Ushirogouchi, et al. discloses a photosensitive composition useful for a fine working in the manufacture of, for example, a semiconductor element, a TFT (thin film transistor), a photo-disk, etc., and a method of forming a pattern using this composition, the composition comprising an oligomer having a backbone chain comprising an alicyclic skeleton and/or a conjugated polycondensed aromatic

skeleton, the backbone chain being acid-decomposable or hydrolyzable; and a photo-acid-generating agent. Note column 1, lines 6-10, and column 2, lines 62-67. Note also column 4, lines 12-15. As applied by the Examiner, note column 30, lines 30-56.

The Examiner has particularly directed attention to column 30, lines 36-38, of Ushirogouchi, et al. However, it is respectfully submitted that, as presently claimed, at least one of R_4 and R_5 is selected from the group consisting of substituents set forth in formulas (7)-(9). Thus, the compound represented by the general formula (10) is not a primary amine (that is, both of R_4 and R_5 cannot be H). As described on page 19, lines 20-23, of Applicants' Substitute Specification, when the amine functional group is a primary amine, stability of the photosensitive resin composition may be lower due to a side reaction; and, at least one of the two hydrogen atoms on the primary amine functional group is replaced by another atom or another functional group. Taking the teachings of Ushirogouchi, et al. as applied by the Examiner, including disclosures in column 30 of the diamines described therein, it is respectfully submitted that the teachings of this reference do not disclose, nor would have suggested, such photosensitive resin composition or use thereof, or electronic part made using such composition, as in the present claims, wherein, inter alia, at least one of R_4 and R_5 is selected from the group consisting of the formulas (7)-(9), and advantages achieved due thereto.

It is emphasized that through use of the photosensitive resin composition as in the present claims, having, inter alia, both the heat-resistant polymer (A) and the compound (B) represented by the general formula (10), a good stability of the composition is achieved, while other properties, both of the claimed composition and after curing, are good. In particular, photosensitivity and resolution, properties of the

composition, are good, and properties after curing, such as elongation ratio, are good. It is respectfully submitted that the teachings of the applied references, including Ushirogouchi, et al., would have neither taught nor would have suggested a composition or use thereof as in the present claims, and good results achieved thereby.

In view of the foregoing comments and amendments, reconsideration and allowance of all claims presently pending in the above-identified application are respectfully requested.

To the extent necessary, Applicants hereby petition for an extension of time under 37 CFR 1.136. Kindly charge any shortage of fees due in connection with the filing of this paper, including any extension of time fees, to the Deposit Account of Antonelli, Terry, Stout & Kraus, LLP, Account No. 01-2135 (case 1270.46593X00), and please credit any overpayments to such Deposit Account.

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP

By /William I. Solomon/

William I. Solomon

Registration No. 28,565

WIS/ksh
1300 17th Street N., Suite 1800
Arlington, Virginia 22209
Tel: 703-312-6600
Fax: 703-312-6666